TIER 2

UNDERGROUND INJECTION CONTROL
PERMIT APPLICATION

Ute Tribal # 17-12
2527' FSL & 612' FWL
Sec. 17, T5S-R3W
Duchesne County, Utah
API # 43-013-31713

July 2015

Prepared for:
Bruce Suchomel
Groundwater Program, Mail Code 8P-W-UIC
U.S. Environmental Protection Agency
1595 Wynkoop St
Denver, CO 80202-1129

Prepared by:
Petroglyph Energy, INC.
960 Broadway Avenue, Suite 500, P.O. Box 70019
Boise, Idaho 83707
(208) 685-7600
FAX (208) 685-7605

TIER 2

- SUNDRY REPORTS.
- CBLS for AOR well

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LIST OF ATTACHMENTS

Attachment No. 1	Area Topography Map
Attachment No. 2	Site Map
Attachment No. 3	Map of the A-Marker surface
Attachment No. 4	Cross-Sections of the injection formation
Attachment No. 5	Water Analysis
Attachment No. 6	Completion data for all wells in the AOR
Attachment No. 7	CBL for the UIC well
Attachment No. 8	Open hole log for the UIC well
Attachment No. 9	List of owners and Affidavit Notification
Attachment No. 10	Well bore diagrams for the UIC well
Attachment No. 11	P&A procedure
Attachment No. 12	MIT procedure
Attachment No. 13	Surety Bond letter

SUMMARY DOCUMENT
UIC WELL APPLICATION
Ute Tribal 17-12
API # 43-013-31713

The following document contains information provided in support of the application for the conversion of the Ute Tribal 17-12 well to an injection well in the Green River formation in the Antelope Creek Field in Duchesne County, Utah.

The Antelope Creek Field falls within the Uintah and Ouray Indian reservations and is within Indian Country; therefore, for facilities located on the reservation, only EPA-issued UIC permits are necessary for compliance with UIC regulations.

The EPA has issued an Area Permit #UT20736-00000 for the Underground Injection Control for the Antelope Creek Field. This area permit allows for additional producing wells to be converted to injection wells for enhanced recovery.

(1) Petroglyph Energy, Inc. (Petroglyph) is the operator and only working interest owner of wells located in the Antelope creek Field, Duchesne County, Utah. Petroglyph's business address is provided below:

Petroglyph Energy, Inc.
960 Broadway Avenue, Suite 500
P.O. Box 70019
Boise, ID 83707

(2) Enclosed as Attachment No. 1 is a topographic map of a portion of the Antelope Creek Field, identifying all wells located in this area. The legal location for the Ute Tribal 17-12 is 2527' FSL & 612' FWL NW/SW Sec. 17, T5S-R3W.

(3) Attachment No. 2 is a map of the well. This map shows a circle with a ¼ mile radius centered on the Ute Tribal 17-12 well. The ¼ mile radius encompasses the area of review, AOR, within which Petroglyph is required to investigate all wells for mechanical integrity. The ¼ mile radius also identifies mineral ownership; all lands within the AOR are leased to Petroglyph by the Ute Tribe as indicated by yellow shading. The AOR has Ute Tribal 17-05, Ute Tribal 17-12F, Ute Tribal 17-12M, Ute Tribal 18-09, and Ute Tribal 18-16J well(s) located in its ¼ mile radius.

(4) Petroglyph proposes to utilize the Ute Tribal 17-12 as an injection well for enhanced recovery in the Antelope Creek Field.

(5) Injection Zone – The injection intervals are between 3855' and 5842' True Vertical Depth and located in the lower portion of the Green River Formation. The injection zone is confined within a 1987' section between the Green River "A" Lime marker bed and the top of the Basal Carbonate in the lower part of the formation. The injection zone is composed of lenticular calcareous sandstones interbedded with low permeable carbonates and calcareous shales. The lenticular sandstones vary in thickness from 1 to 30 feet.

Confining Zone – The overall confining strata above the injection zone consists of impermeable Green River calcareous shales and continuous beds of microcrystalline dolostone. The confining zone in the Ute Tribal 17-12 is 232 feet thick.

Attachment No. 3 is a structure map of the A-Marker surface.

Attachment No. 4 is a cross-section of the injection interval and confining zone.

(6) Enclosed as Attachment No. 5 are standard analyses of produced water from three batteries that currently serve as central handling facilities for all project producing wells. The analysis of the Green River formation water from the Ute Tribal 18-08 Satellite Battery is 12805 mg/L of total dissolved solids (TDS), Ute Tribal 21-11 Satellite Battery is 15659 mg/L TDS, and Ute Tribal 34-12-D3 Satellite Battery is 14590 mg/L TDS.

Injectate in the field is a mixture of produced water and fresh make-up water. The nearest injection well is the Ute Tribal 18-09, the most recent analysis of the water being injected into the Green River formation at this location is 6316 mg/L TDS. This analysis is also included in Attachment No. 5.

(7) A summary of completion data from the Ute Tribal 17-12 and offset wells in the AOR are included in Attachment No. 6

(8) The cement bond log is included in Attachment No. 7.

(9) The open hole log for the Ute Tribal 17-12 is included in Attachment No. 8.

(10) The Antelope Creek Field is operated under a Cooperative Plan of Development between the Ute Tribe and Petroglyph Energy. At the Ute Tribal 17-12 location, all mineral owners, surface owners and operators located within the AOR ¼ mile radius have been notified of the submitted EPA application to convert to injection. Attachment No. 9 is the Affidavit of Notification to all owners.

(11) Petroglyph requests a maximum surface injection pressure of **1818**psi. The EPA Area Permit No. UT20736-00000 uses the formula:

Pm = (0.88psi/ft - 0.43psi/ft(Sg)) D

Where:
Pm = Maximum surface injection pressure
0.88psi/ft = Fracture gradient
D = Top perforation depth
0.43psi/ft = Hydrostatic pressure/hydraulic head
Sg = Specific gravity of injection fluid

For the Ute Tribal 17-12:
1818psi = (0.88psi/ft - 0.43(1.00)) 4040ft

(12) Three wellbore diagrams for the Ute Tribal 17-12 are in Attachment No. 10. One diagram is for production, one for injection, and one for Plug & Abandonment (P&A).

(13) The P&A procedure for this well is shown in Attachment No. 11.

(14) Once the draft permit is issued, Petroglyph will conduct a Mechanical Integrity Test and a static bottom-hole pressure test. The MIT procedure is contained in Attachment No. 12. The conversion work will be satisfactorily completed and submitted to the EPA on Form 7520-12. A wellbore schematic will be included with this form.

(15) Petroglyph will give proof of financial responsibility by posting a surety bond for the UIC well prior to final permit approval. A copy of this letter is contained in Attachment No. 13.

(16) Petroglyph will install various gauges on the well so that the injection pressure and tubing/casing annulus pressure can be monitored. The well will be equipped with a flow meter with a cumulative volume recorder.

Ute Tribal 17-12 Well History

Well History:

Spud Well: 10/8/1996

Completed: 11/11/1996

First Production: 12/25/1996

Tops (KB):

BMSW* Found at 1092'

Green River 1271'

A Marker 3855'

X Marker 4342'

Douglas Creek 4488'

B Limestone 4874'

Castle Peak 5390'

Basal Carbonate 5842'

Perf History

11/8/1996

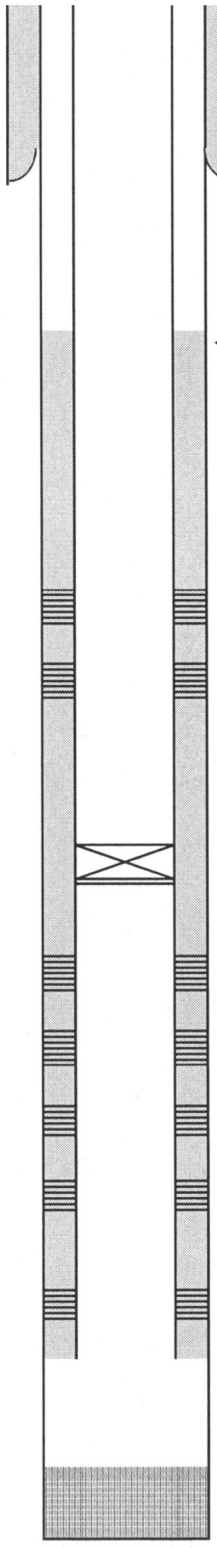
C06	4692' to 4696'
D3	4970' to 4973'
E01.2	5486' to 5490'
E01.2	5498' to 5502'

10/12/2010

B06	4040' to 4054'
B06	4062' to 4072'
B10	4260' to 4266'
B11.1	4298' to 4304'
C03.2	4465' to 4481'
E01.2	5482' to 5491'
E01.2	5496' to 5502'
E01.2	5506' to 5513'

10/14/2010

BP	at 4650'



GL: 6082'

KB: 6092'

8 5/8" 24# Surface CSG @ 412' KB

cmt'd w/250 sx

Surface Hole size 12 1/4"

Cement top @ 2250'

5 1/2" 15.5# J-55 CSG @ 5866'

cmt'd w/455 sx

Hole Size 7 7/8" bit

Perf's:

B06 4040' to 4054'

B06 4062' to 4072'

B10 4260' to 4266'

B11.1 4298' to 4304'

C03.2 4456' to 4481'

BP @ 4650'

C06 4692' to 4696'

D3 4970' to 4973'

E01.2 5482' to 5491'

E01.2 5496' to 5502'

E01.2 5506' to 5513'

PBTD @ 5836' KB

TD @ 6160' KB

(Not to Scale)

Petroglyph Operating Co., Inc.

Ute Tribal #17-12

(2527' FSL & 612' FWL)

NW SW Section 17, 5S- 3W

Antelope Creek Field

Duchesne Co. Utah

API#: 43013317130000

*Plate 1 Utah Geological Survey Special Study 144. (2012). *BMSW Elevation Contour Map, Uinta Basin, Utah.* [map]. (CA 1:200,000)

Ute Tribal 17-12 Injection

Well History:

Spud Well: 10/8/1996

Completed: 11/11/1996

First Production: 12/25/1996

Tops (KB):

BMSW* Found at 1092'

Green River 1271'

A Marker 3855'

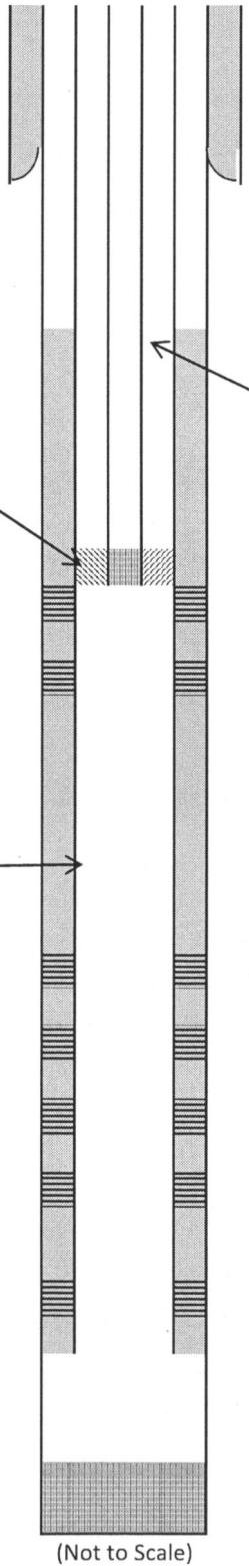
X Marker 4342'

Douglas Creek 4488'

B Limestone 4874'

Castle Peak 5390'

Basal Carbonate 5842'



GL: 6082'

KB: 6092'

8 5/8" 24# Surface CSG @ 412' KB

cmt'd w/250 sx

Surface Hole size 12 1/4"

Cement top @ 2250'

5 1/2" 15.5# J-55 CSG @ 5866'

cmt'd w/455 sx

Tubing 2 7/8" 6.5# J55

Injection packer @ 3950'

Hole Size 7 7/8" bit

Perf's:

B06 4040' to 4054'

B06 4062' to 4072'

B10 4260' to 4266'

B11.1 4298' to 4304'

C03.2 4456' to 4481'

C06 4692' to 4696'

D3 4970' to 4973'

Remove BP @ 4650'

E01.2 5482' to 5491'

E01.2 5496' to 5502'

E01.2 5506' to 5513'

Petroglyph Operating Co., Inc.

Ute Tribal #17-12

(2527' FSL & 612' FWL)

NW SW Section 17, 5S- 3W

Antelope Creek Field

Duchesne Co. Utah

API#: 43013317130000

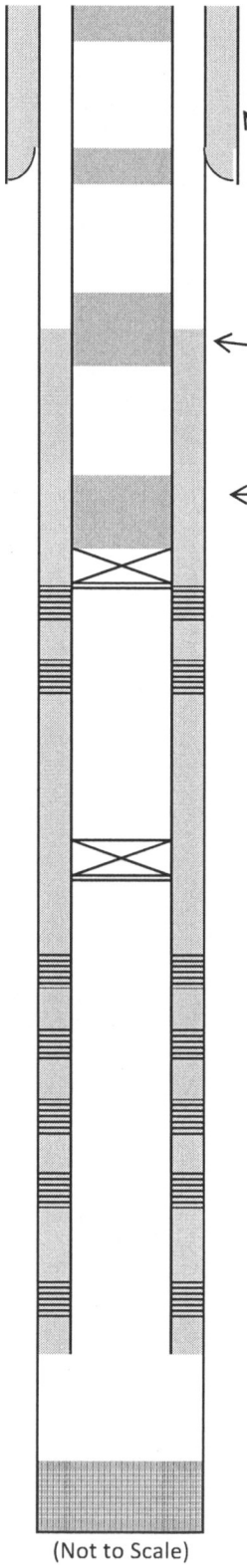
PBTD @ 5836' KB

TD @ 6160' KB

*Plate 1 Utah Geological Survey Special Study 144. (2012). *BMSW Elevation Contour Map, Uinta Basin, Utah.* [map]. (CA 1:200,000)

(Not to Scale)

Ute Tribal 17-12 Plug and Abandonment



8sx Class G Cement-50' plug

15sx Class G Cement-100' plug

30sx Class G Cement-200' plug

30sx Class G Cement-200' plug

CIBP @ 3950'

GL: 6082'

KB: 6092'

8 5/8" 24# Surface CSG @ 412' KB

cmt'd w/250 sx

Surface Hole size 12 1/4"

Cement top @ 2250'

5 1/2" 15.5# J-55 CSG @ 5866'

cmt'd w/455 sx

Hole Size 7 7/8" bit

Perf's:

B06 4040' to 4054'

B06 4062' to 4072'

B10 4260' to 4266'

B11.1 4298' to 4304'

C03.2 4456' to 4481'

BP @ 4650'

C06 4692' to 4696'

D3 4970' to 4973'

E01.2 5482' to 5491'

E01.2 5496' to 5502'

E01.2 5506' to 5513'

PBTD @ 5836' KB

TD @ 6160' KB

(Not to Scale)

Petroglyph Operating Co., Inc.

Ute Tribal #17-12

(2527' FSL & 612' FWL)

NW SW Section 17, 5S- 3W

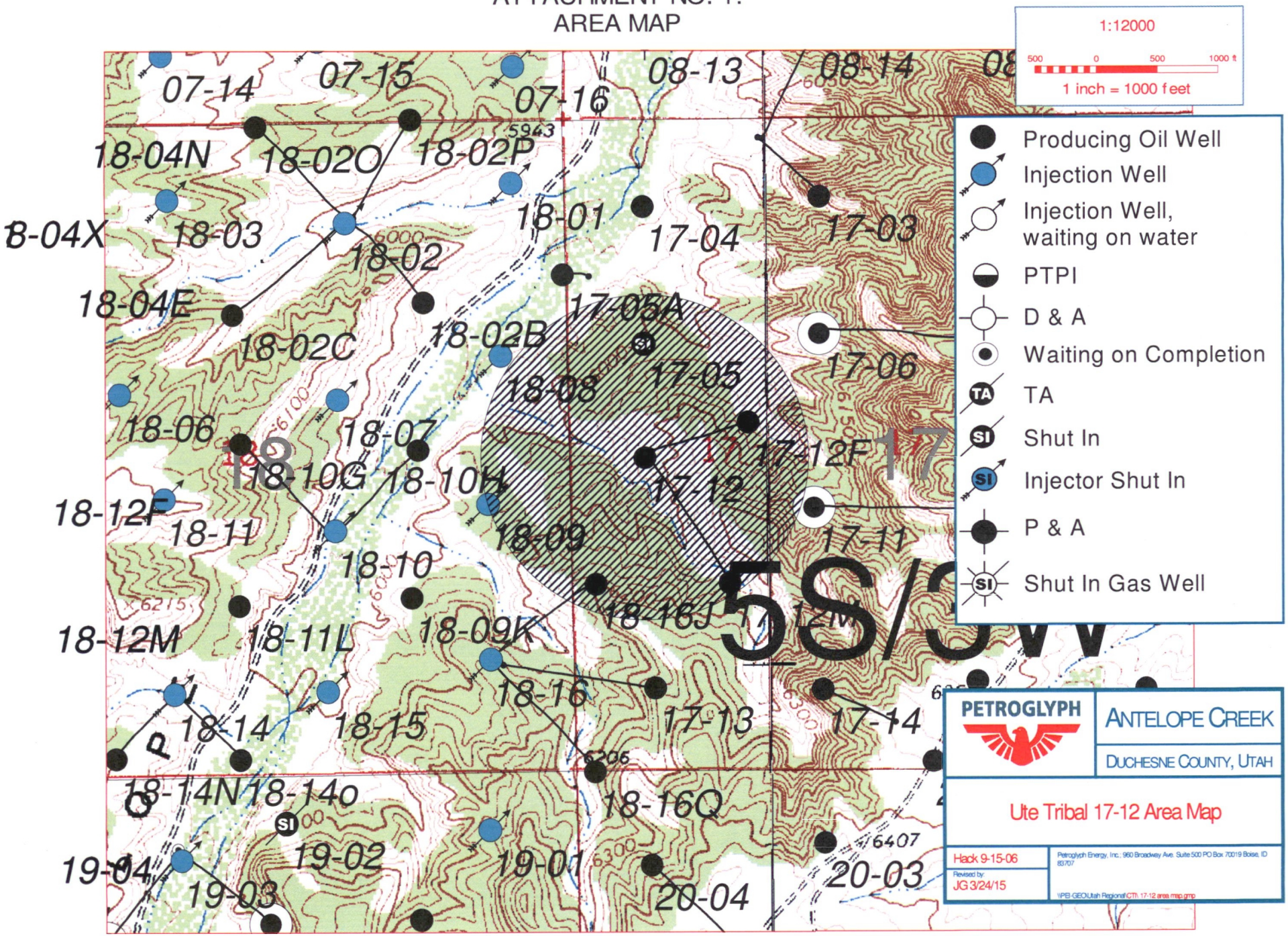
Antelope Creek Field

Duchesne Co. Utah

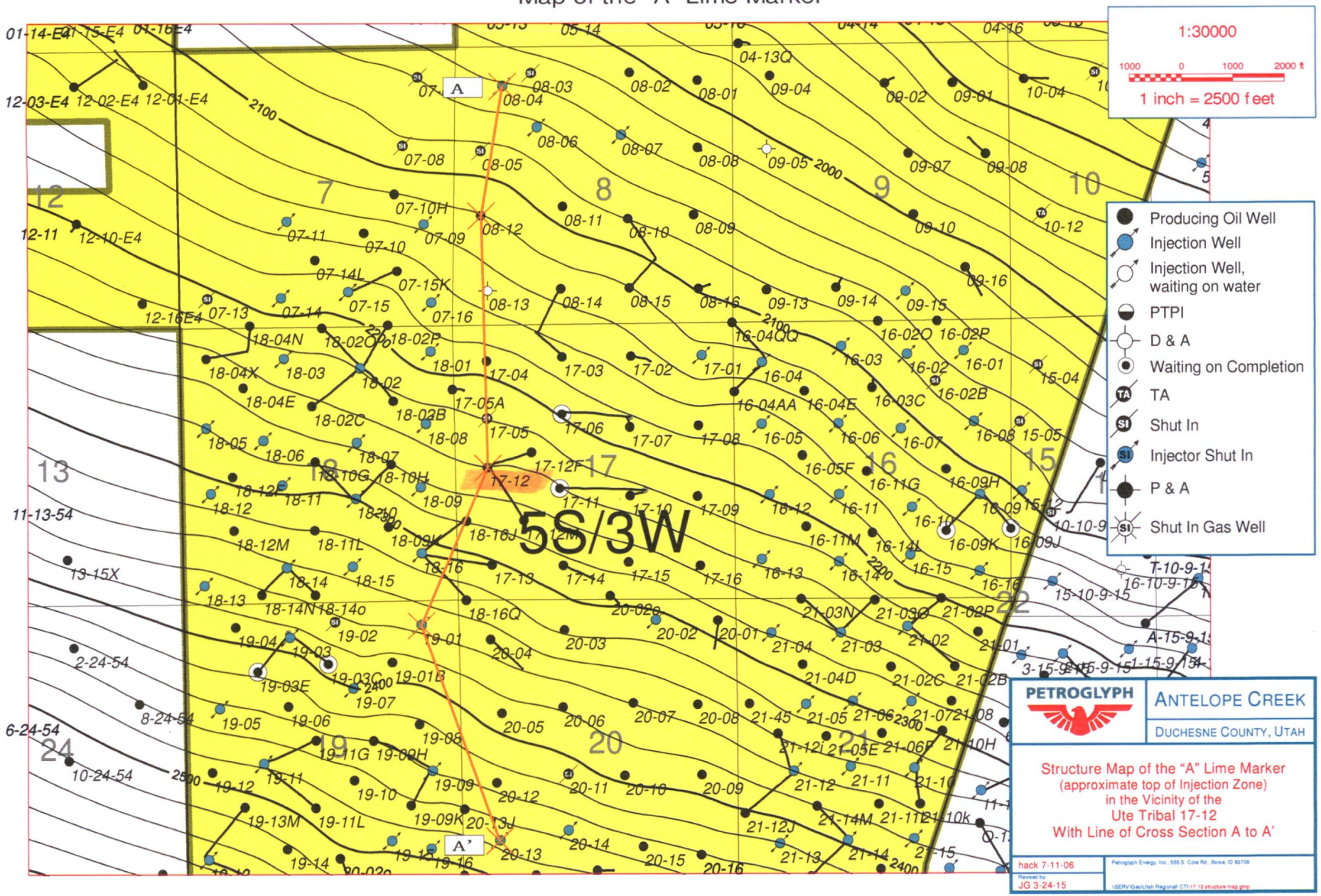
API#: 43013317130000

*Plate 1 Utah Geological Survey Special Study 144. (2012). *BMSW Elevation Contour Map, Uinta Basin, Utah.* [map]. (CA 1:200,000)

ATTACHMENT NO. 1:
AREA MAP



ATTACHMENT NO. 3:
Map of the "A" Lime Marker



Well Completion Data
Ute Tribal 17-12

	Surface Casing				Production Casing			
Well	Size (inches)	Depth (ft KB)	Cement Amount (sx)	Cement Top	Size (inches)	Depth (ft KB)	Cement Amount (sx)	Estimated Cement Top
Ute Tribal 17-12	**8-5/8**	**412**	**250**	**surface**	**5-1/2**	**5866**	**455**	**2250**
Ute Tribal 17-05	8-5/8	402	250	surface	5-1/2	6106	355	3030
Ute Tribal 17-12F	8-5/8	550	350	surface	5-1/2	6039	840	surface
Ute Tribal 17-12M	8-5/8	550	360	surface	5-1/2	6066	820	surface
Ute Tribal 18-09	8-5/8	395	225	surface	5-1/2	5700	1200	surface
Ute Tribal 18-16J	8-5/8	500	350	surface	5-1/2	6100	901	surface

Cement Bond Index (in millivolts - mV)

Date: September 8, 2015

Operator: **Petroglyph**

Well: **Ute Tribal 20-12**

Permit :

Enter the following values:

Amplitude at 0% Bond (A-0) (in mV) = **72** *mV*

Amplitude at 100% Bond (A-100) (in mV) = **1** *mV*

Amplitude at 80% Bond (A-80) = **2.4** *mV*

[(0.2)log A0 + (0.8)log A100]

Amplitude at 90% Bond (A-90)= 1.5 *mV*

[(0.1)log A0 + (0.9)log A100]

Amplitude at 70% Bond (A-70)= 3.6 *mV*

[(0.3)log A0 + (0.7)log A100]

Amplitude at 60% Bond (A-60)= 5.5 *mV*

[(0.4)log A0 + (0.6)log A100]

Maximum Allowable Injection Pressure (MAIP)
From Fracture Gradient

Date: 09/08/2015 *Operator:* **Petroglyph**

Well: **Ute Tribal 17-12**

Permit #:

Enter the following values:

Specific Gravity of injectate =	**1.010**	g/cc
Depth to top of injection interval =	**3,855**	feet
Fracture Gradient (F G) =	**0.880**	psi/ft

MAIP = **1,705** psig

(rounded down to nearest 5 psig)

where:

*MSIP = [FG - (0.433 * SG)] * Depth to top of injection interval =* *1706.493*

[redacted] - Technical Review Worksheet

Permit No: UT2 Well: UT 17-12

What Needs to be Done	Information Sources	Review & Evaluation Notes
Determine name, top and base of the confining zone(s) and the injection zone(s).	☐ Geologic data submitted ☐ Well logs from area ☐ Published articles	Conf Zone: top 3623 base 3855 Inj Zone: top 3855 (Garden Gulch 2-Marker) base 5842 (top Wasatch)
Determine name, top and base of all USDWs. List base of lowermost USDW: Determine which USDWs are actually being used for water supply.	☐ Geologic data submitted ☐ nearby Water analyses ☐ nearby Well logs ☐ Water supply wells ☐ Published articles	Surface Elevation: GL 6082 KB 6092 Pub #92 base USDW: bgs: elev: submitted base USDW bgs: 1092 elev: base of Uinta / top Green River: 1271
Review and evaluate construction, casing and cementing records of proposed well.	☐ Data submitted ☐ Completion/workover reports ☐ Contractor invoices ☐ Logs: CBL, RTS, Temp, casing inspection, etc.	TD: 6160 KB PBTD: 5836 KB surface csg 8 5/8" 24# ft 0-412 s: long strg csg 5 1/2" 15.5# ft 0-5846 s: TOC: submitted: 2250 CBL: 2400
Review and evaluate construction, casing and cementing records of AOR wells that penetrate injection zone.	72/1 2.4≥80% OK	Wells in AOR: TD TOC C 17-12F 6039 SURF 17-12M 6066 SURF 17-05 6106 3630 18-09 5700 SURF 18-16S 6100 SURF
Review P&A plan for effective USDW protection, injection zone isolation and well closure.	☐ P&A plan ☐ Area geology	plug depths:
Review amount of FR - is it adequate to cover P&A costs of proposed in P&A plan?	☐ contractor bids / P&A cost histories ☐ nearby well P&A costs	FR instrument: Amount: $
Calculate the maximum allowable injection pressure (MAIP).	☐ Fracture treatments ☐ Step Rate Test results ☐ Fracture gradient	top perforation: 4040 bottom perforation: 5513 injectate specific gravity: 1.01 Frac Gradient: .88 p: initial MAIP = 1705 psi
Determine which logs and tests will be performed.		

Structural Cross Section A to A' in the Vicinity of Ute Tribal 17-12

43013307590000	2485 ft	43013311640000	4827 ft	43013317130000	3266 ft	43013319640000	4347 ft	43013319810000
PETROGLYPH OPERATING COMPANY INC Ute Tribal 08-04 754 FNL 888 FWL TWP: 5S - Range: 3W - Sec. 8		PETROGLYPH OPERATING Ute Tribal 08-12 2100 FSL 515 FWL TWP: 5 S - Range: 3 W - Sec. 8		PETROGLYPH OPERATING COMPANY INC UTE TRIBAL 17-12 2527 FSL 612 FWL TWP: 5 S - Range: 3 W - Sec. 17		PETROGLYPH OPERATING COMPANY INC Ute Tribal 19-01 473 FNL 706 FEL TWP: 5 S - Range: 3 W - Sec. 1		PETROGLYPH OPERATING COMPANY INC Ute Tribal 20-13 700 FSL 700 FWL TWP: 5 S - Range: 3 W - Sec. 2